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HAND-BOOKS  
OF  
COMMERCIAL PRODUCTS.

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INDIAN SECTION.

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No. 17.  
GARJAN OR KANYIN OIL  
AND  
IN OR ENG OIL.

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## PREFACE.

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The Government of India have arranged to provide to the Imperial Institute for the illustration of the Economic Products of India—

- (A) a descriptive Catalogue or Dictionary ;
- (B) an index collection of all products ;
- (C) a commercial collection of special products ;
- (D) a hand-book descriptive of C.

A.—The descriptive Catalogue has been completed, and is termed the "Dictionary of the Economic Products of India." The compilation has occupied eight years, and has been made under the Editorship of Dr. G. Watt, C.I.E., Reporter on Economic Products to the Government of India. It has been confined to the collation of facts and statistics available up to the date of the publication of the work.

To each product there is assigned in the Dictionary a separate number, which will be permanently maintained for purposes of reference.

B.—The index collection will, when completed, be comprised of small samples of every economic product of India, which will bear the same numbers as those assigned to the products in the Dictionary.

C.—The commercial collections are on a larger scale. The number of products of which a collection is provided each year will be limited to about twenty.

Each collection will comprise as complete a set of specimens of the product in its raw and manufactured state as is necessary for the fulfilment of the object with which the commercial collections and hand-books are provided.

D.—The hand-books will supply, in a separate pamphlet for each product, the information contained in the Dictionary, amplified by supplementary facts and statistics, and illustrated by maps, diagrams, photographs, etc.

The objects of the commercial collections and hand-books which accompany them are—

1. To secure, while each collection is being made for the Institute, a thorough and special investigation in India through which fresh information regarding the product concerned, not contained in the Dictionary, may be obtained.
2. To illustrate the Dictionary in a manner more complete than can be effected by the index collection.
3. In the case of products which are not generally known—
  - (a) to bring them to the notice of those interested ;
  - (b) to indicate the extent to which, and conditions under which they are procurable ;
  - (c) to ascertain their commercial value ;
  - (d) to secure, through the Governing Body of the Institute and commercial experts whom they may consult, such special trial or analysis of them as can be more effectually made in England than in India.

E. C. BUCK,

*Secy. to the Govt. of India,  
Dept. of Revenue and Agriculture*

*April 10th, 1893.*



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[These products are described in Dr. Watt's Dictionary of Economic Products, Vol. III, D. 701—720 and D. 696—700.]

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## GARJAN OR KANYIN OIL.

In this hand-book the articles in the Dictionary of Economic Products by Dr. G. Watt have been reproduced with additions. Its main object is to draw attention to Garjan oil, which is used (I) in the treatment of leprosy and other diseases, and which might, (II) if a process of drying it quickly could be discovered, come largely into use in Europe as a varnish, and might also be utilised (III) as a solvent of caoutchouc and (IV) in the manufacture of water-proof cloth.

### OLEO-RESIN.

Considerable confusion exists in the literature of garjan and wood-oil. Apparently several species of *Dipterocarpus* yield balsamic products, to which it would seem the name garjan oil is assigned. In Burma one set of oils is, however, collectively spoken of as Kanyin-oils, another as In-oils. The term garjan appears to be unknown to the Burmans.

In the Dictionary of Economic Products Kanyin oil is described under the heading *Dipterocarpus turbinatus*, Gærtner, which species is regarded, in the 'Flora of British India', as synonymous with *D. lævis*, Hamilton. As regards the synonymy, Dr. George King, Superintendent, Calcutta Botanical Gardens, writes to the editor, as follows: "In the 'Flora of British India' there is included under the species *D. turbinatus*, Gærtner f., the tree named *D. lævis* by Buchanan-Hamilton in the Memoirs of the Wernerian Society, Vol. VI, p. 299. Hamilton distinguishes his species *D. lævis* by its flattened branchlets and perfectly glabrous leaves and petioles; while *D. tuberculatus*, Gærtner., has terete branches and pubescent leaves and petioles. The former (called *dolia garjan* by the natives of Chittagong) yields, he says, no wood-oil; while the latter (called *telia garjan*) does. The materials before me do not enable me to differentiate the two as species. Moreover, specimens sent by you (and which had been collected by the Forest Officer of Chittagong, under the vernacular names *dolia* and *telia garjan*) appear to be exactly alike. Careful investigation in the field may, however, prove that there is some better basis for Hamilton's view than the trifling differences which he has noted in the outline of the branchlets and the pubescence of the leaves."

A reference was made by the Revenue and Agricultural Department to the Government of Burma for particulars, to be inserted in

27 Oct '37

Gillet

the Dictionary of Economic Products, as to the various species of *Dipterocarpus* that yield wood-oil (garjan), and the following instructive reply was received:—"Kanyin oil is the produce of *D. lævis* (*kanyin-ni*=red kanyin) and *D. alatus* (*kanyin-byu*=white kanyin) which are common in evergreen forests, and probably of other species of similar habitat. The oil is generally collected only in the dry weather (November to May). It is obtained by cutting two or three deep pyramidal hollows (the apex pointing towards the interior of the stem) near the foot of the tree, and by applying fire to the upper cut surfaces. The oil then collects at the bottom of the hollow, which is emptied every three or four days. Fire is applied every time the oil is removed, and the upper surfaces of the hollow are re-chipped three or four times during the season. In the Tharrawaddy district, where trees are not very plentiful, twenty are about as many as one man can attend to. The yield of twenty trees would be about 100 viss for the season, worth R25. In the Prome district oil only comes into the market in the form of torches, which are made of rotten wood steeped in oil and rolled up in *salu* leaves (*Licuala peltata*). The exports of kanyin oil from Burma ports during 1887-88 were as follows:—

						R
Rangoon	.	.	18,826 gallons valued at	.	.	16,302
Moulmein	.	.	782 „	.	.	575
Mergui	.	.	55,470 viss	.	.	9,394

The exports of torches were:—

						R
Tavoy	.	.	2,000 valued at	.	.	30
Mergui	.	.	850,225 „	.	.	22,372

"Collectors do not keep the oil from the different kinds of kanyin trees separate, so that the oil which comes into the market is the produce of different species mixed in varying proportions. The Mergui kanyin tree seldom exceeds 6 feet in girth, and is probably distinct from the species found in Pegu and North Tenasserim, which commonly attains a girth of from 15 to 25 feet."

Two other communications, procured through the circular letter alluded to above, may be here published. The Conservator of Forests in Bengal reported: "*Dipterocarpus turbinatus*, the *teli-gurjun* of Bengali, is found in the Chittagong District. It is prohibited to tap in the Collectorate owing to the large number of trees already killed by tapping. This prohibition does not extend to the Hill Tracts. As much of the oil exported from the hill tracts is shoulder-borne, the total amount exported cannot be definitely stated. But the total amount carried past the revenue stations, and which paid a royalty of 10 per cent. *ad valorem* from 1883-84 to 1887-88 may be said to have been as follows: 1883-84, 355 maunds, 1884-85, 125 maunds, 1885-86, 96 maunds, 1886-87, 60 maunds, and 1887-88, 51 maunds.

"The mode of tapping is to cut a deep hollow in the tree, and keep live charcoal in it at night. The oil is removed in the morning, and fresh live charcoal put in again at night. It is repeated till the oil ceases to flow. Three, four, or more such deep hollows are often cut in the same tree, with the not surprising result that the tree is killed. The falling-off in exports is most probably due to most of the trees having been ready killed by the tapping." A sketch was furnished along with the



above report, in which the notch made in the trees was shown to be the same as that made in Burma. In this way a cavity is formed with a flat bottom, on which it would be possible to deposit live charcoal, but it may here be added that in Burma charcoal does not appear to be used.

The other communication was from the Conservator of Forests, Coorg, which gives an account of the wood-oil prepared in that portion of the west coast of Southern India. The Conservator writes: "We have two oil trees in the Western Ghat Forests of Coorg. Both, I believe, are species of *Dipterocarpus*, but I have not been able to get the flowers to identify them. The oil is contained in the pores of the wood, and is collected by cutting a hole into the centre of the tree. One species yields a yellow oil, and the other a dark red. The former is sold in the bazaars mixed with dammar (the produce of *Vateria indica*) as varnish at 5 annas a bottle. The latter also makes a fair varnish. It has a strong copaiba-like smell, and would probably be useful in medicine."

More recently the Deputy Conservator of Forests, Coorg, wrote to the effect that "practically nothing is known of the oil of *Dipterocarpus lævis* (the species in Coorg) in the local markets. The tree is locally known as the *yenni mara* (oil tree) or *balúth mara* (large tree), but there is no regular collection of the oil. What is sold in the Mercara bazár as wood-oil is said by the sellers to come from Madras, and this I am inclined to believe, for the minor forest products of Coorg are almost unknown."

Gamble points out that, according to the 'Flora of British India', *D. indicus*, Beddome, may be reduced to either *D. turbinatus* or *D. lævis*. He appears, however, to view it as a distinct species, a native of the Western Ghats, which is there known as *guga* and *walivara* in Kanares. The garjan oil reported to be made in South India would, accordingly, be the product of *D. indicus*.

During a conversation on this subject with the writer, Mr. Ribbentrop remarked that it was impossible to mistake the trees that yield Kanyin and In oils. *D. tuberculatus*, the In, was a low growing tree found only on the *indaing* soils, and forming dense forests somewhat like its associate the *Sál* (*Shorea robusta*.) This was in his opinion the chief if not sole source of the oil which was collected in the autumn and cold season, flowing from a wound without the aid of fire. The other trees alluded to were *D. turbinatus*, *D. lævis*, and *D. alatus*. These are very lofty, occur in mixed forests, and tower above the surrounding trees. They frequent deep rich soils, and yield in spring their oleaginous products on being charred. Mr. Ribbentrop regards *D. lævis* as distinct from *D. turbinatus*; the former being a much loftier tree than the latter. Kurz mainly distinguishes these plants by the former being glabrous, while the latter is hairy.

The following notes were recently submitted by the Conservator of Forests, Upper Burma, and the Deputy Conservators of Forests, Chittagong and the Andaman Islands, in connection with collections made for the Imperial Institute.

(a) *Upper Burma.*

The kanyin tree (probably various species of *Dipterocarpus*) occurs in this circle only in the upper part of the Chindwin river, where the

forests appear to approximate to those of Tenasserim and the Andamans, the rainfall being very considerable. The forests in which it occurs have rarely, if ever, been visited by European Forest Officers or even subordinate Forest Officers. For working kanyin oil the following licenses have been issued during the last three years in the Chindwin division :—

1889-90 . . . . .	2 licenses.
1890-91 . . . . .	4 „
1891-92 . . . . .	73 „

The following report was recently drawn up by Mr. W. A. Hearsey, Assistant Conservator of Forests, Shwegu Sub-division :—

Mr. Hearsey went, early in April, 1893, to the Hwehu Forest, 5 miles south of Shwegu, to select kanyin trees (*kanyin ni*) for tapping.

The trees were found growing in clumps, in hollows and ravines, chiefly near water, in a mixed forest of Teak and In.

Eleven trees, varying from 7'7" girth and 74' height to 21'9" girth and 180' height, were selected. These trees had clean boles up to a good height, and the depth of the crowns was about a fifth of their whole height.

Of the 11 trees which were tapped, 10 were fired, and only 8 gave any result, the total yield being 27 quart bottles of oil, mixed with a thick whitish-coloured resin. One tree, growing in the shade surrounded by thick undergrowth, yielded no oil or resin at all. Two blazes were made in the largest tree, and 1½ quart bottles of oil obtained.

The blaze is usually made at a height of about 4 feet from the ground on the side most exposed to the sun. It is concave, and the bottom is scooped out to a depth of about 12" to retain the oil. The width of the cut varies from 1'6" to 2', and the height from 12" to 18" according to the size of the tree. After the blaze is completed it is filled up with dry leaves and grass, which are set on fire. The fire is allowed to burn for about a quarter of an hour, and is then put out. The oil commences to flow immediately, and when the flow decreases owing to the pores getting blocked up, the blazes are cut afresh, and the firing operation is repeated. The blazed trees were fired four or five times, or about once in ten days. The oil is collected every three or four days.

Mr. Hearsey found that trees growing amidst a dense undergrowth, the boles of which are shaded from the direct rays of the sun, yield a very small quantity of oil as compared with those growing singly, and exposed to the full benefit of the noon-day sun. Three of the trees growing in heavy shade, which were tapped, yielded only 4 quart bottles of oil. One tree which was not fired, but was growing in an exposed spot, yielded 1½ quart bottles of oil. The trees must be fired to obtain a copious flow of oil. Firing does not kill the trees, nor do the leaves wither after firing. The only fear is from jungle fires.

The total quantity of oil collected from 7th April to 26th May was 28½ quart bottles at a cost of Rs 10-8. A large quantity could be extracted at a smaller cost.

The kanyin trees are scattered over a very large area in the Shwegu Sub-division. As far as Mr. Hearsey could find out, the Burmans do not



extract the oil there for trade purposes, but use it in small quantities medicinally for sores on their buffaloes.

Herbarium specimens sent by Mr. Hearsey have been identified by Dr. G. King as *Dipterocarpus lævis*, Ham.

(b) *Chittagong*.

There are three kinds of garjan tree in this division, viz. :—

- (a) Tailia — From this tree oil is obtained, and the leaves are considerably larger than those of either of the other kinds.
- (b) Bhoita.—From this tree oil is obtained, but it congeals at once. The bark is thick and very white, and the leaves are very small.
- (c) Dholia — From this tree no oil is obtained. The bark is white, but thinner than that of either of the other two, and the leaves are larger than those of bhoita, but smaller than those of tailia.

All three kinds exude resin. The local method of tapping and obtaining the oil is as follows :—About 3 feet above the ground a cut, about 8 inches in length, is made with an axe parallel to the ground. From about 4 inches above the centre of the cut, and gradually meeting it at its extremities, the bark is peeled off, and a receptacle made, 3 inches in depth, slightly sloping downwards and inwards to admit of the oil depositing itself and being easily collected. The receptacle thus made is singed with a blazing torch, to accelerate the flow of the oil, weekly or bi-weekly, as may be necessary. The trees are tapped after they have attained the age of 20 years. If the trees are tapped before this age, the effect is most deleterious, as is also the case if more than one receptacle is made. Tapping in any case stunts the growth of the tree, and ruins it for timber purposes, as it generally becomes, under these circumstances, more or less hollow.

The tapping of garjan trees is now prohibited throughout the Government Forests in the Collectorate of Chittagong. The quantity of oil available from the Hill Tracts is estimated at 10,000 lb per annum.

It is reported that torches are not procurable in this district, but that they are used in Arakan.

Specimens of the leaves of the three kinds of garjan tree referred to above were examined by Dr. George King, who reported that they are “all hairy only on the midrib beneath, and would therefore exactly fit Hamilton’s description of *D. lævis*, and Roxburgh’s of *D. turbinatus*.”

(c) *Andamans*.

The field for working is very large, and the large trees are very, very numerous, but the oil is only extracted in small quantities for settlement purposes, and there is no regular trade in it.

The samples of oil sent to the Imperial Institute, which were collected by Burmese convicts, were collected from large trees of two different species of *Dipterocarpus*, viz., *D. Griffithii* and *D. turbinatus* var. *andamanicus*, King.

## VARIETIES OF GARJAN OIL.

The writer can discover no author who has separately distinguished the oleo-resins described above; indeed, in all the published accounts which he has been able to consult, the substance described appears to be that obtained after charring the trees—the kanyin oils. Thus Roxburgh wrote of *D. turbinatus*, that “To procure the balsam, a large notch is cut into the trunk of the tree near the earth (say, about thirty inches from the ground), where a fire is kept up until the wound is charred, soon after which the liquid begins to ooze out. A small gutter is cut in the wood to conduct the liquid into a vessel placed to receive it. The average produce of the best trees during the season is said to be sometimes forty gallons. It is found necessary, every three or four weeks, to cut off the old charred surface, and burn it afresh; in large healthy trees abounding in balsam, they even cut a second notch in some other part of the tree, and char it as the first. These operations are performed during the months of November, December, January and February. Should any of the trees appear sickly in the following season, one or two more years’ respite is given them.” Lieut. Hawkes published, in his report on the oils shown at the Madras Exhibition of 1855, an account of the extraction of this oil by charring, the operation being performed in March or April. But Lieut. Hawkes was apparently, like Roxburgh, ignorant of the oil extracted from *D. tuberculatus* with or without the aid of fire. Sir J. D. Hooker (*Him. Journals, Vol. II, 348*) gives a brief note regarding the oleo-resin obtained in Chittagong from *D. turbinatus*.—He says: “A fragrant oil exudes from the trunk, which is extremely valuable as pitch and varnish, etc., besides being a good medicine. The natives procure it by cutting transverse holes in the trunk, pointing downwards, and lighting fires in them, which causes the oil to flow.” Mason, than whom few more trustworthy authors on Burmese subjects could be found, attributes wood-oil to *D. lævis* and *D. turbinatus*, but says of *D. grandiflora* (a synonym for *D. tuberculatus*) that “the gum of this species, as well as that of the preceding is used by the natives to make torches.” It is, however, significant that Mason should not have described the process of extraction of his “wood-oil” or of the “gum,” or even mentioned the seasons at which these products are obtained. Dr. Cooke, in his report on the Gums, Resins, and Oleo-resins of India, quotes Roxburgh’s description of the process of extraction, and reviews the opinions advanced by Lieut. Hawkes under *D. turbinatus*, *Gærtn. f.*; but under *D. tuberculatus* *Roxb.*, he simply remarks: “A wood-oil, under the name of Eng is said to be the produce of *D. tuberculatus*; this was sent to London from Burma (May, 1874) for valuation and report.” Flückiger and Hanbury (in their *Pharmacographia*) follow the same course, but seem not to have heard of an oil extracted without the aid of fire, such as the thick oleo-resin known in Burma as In oil.

In a further paragraph will be found the opinions of medical writers regarding garjan oil, in which it is held that there are different qualities, some of very considerably higher medicinal merit than others. This fact would point to the desirability of a thorough investigation into the



oleo-resins obtained from all the species of *Dipterocarpus*, in which the chemical properties and industrial merits of each should be separately established. With this in view experiments might be conducted in order to ascertain if *D. tuberculatus* is the only species that affords the oil on being simply tapped, or whether *D. turbinatus* and *D. lævis* might not also do so, and lastly what action or influence the charring process exercises.

It seems probable that, assuming that the oleo-resins from all the species of *Dipterocarpus* are chemically identical, that obtained during a different season of the year, and by a different process, may be distinct or have its properties changed from what might be called the normal secretion of the *Dipterocarpi*. In concluding this brief review of the literature of garjan oil, it may be as well to point out that, according to the report above, the kanyin oil (or that produced by charring the trees) comes into the market mainly as torches. From this fact the inference might be deduced that the garjan oil of commerce was obtained from *D. tuberculatus*, and not from *D. turbinatus* and *D. lævis*, the species to which the oil has hitherto been attributed. The writer must, however, suggest caution in accepting this inference, but it may safely be assumed that at least the thick honey-like form of garjan oil is the In oil of Burma.

#### CHEMICAL PROPERTIES OF GARJAN OIL.

Lieut. Hawkes (in his report on the oils shown at the Madras Exhibition) says that this class of substances, called wood oils, forms the connecting link between the oils and resins of the vegetable kingdom. They consist of a volatile oil holding in solution a resin, and are generally classed under the head of balsams. It is commonly stated that the oil, if set aside for a time, subsides into two substances, *viz.*, a clear thin liquid, floating above a thick mass known as guad. One of the most remarkable properties attributed to this oil is the fact that it is reported to act as a solvent to caoutchouc. This was apparently discovered at the beginning of the present century by Mr. Laidlay, and his experiments will be found in the *Transactions of the Agri-Horticultural Society of India* (Vol. VIII, 345); also reproduced in Mason's *Burma*. Mr. Laidlay directs that the caoutchouc should be dropped into the garjan oil in small pieces. In a few hours it swells, and must then be frequently stirred to facilitate the process. If heat be applied, complete solution is speedily effected. The solution obtained may be spread on cloth, which is said to be thus rendered waterproof. This fact appears to have been practically lost sight of, while it might prove the key to an industrial utilisation of the substance, since such water proofings would, from the property of the garjan oil, be at least proof against the attacks of insects, if they were not found in addition to possess other useful properties.

A sample of garjan oil obtained from Moulmein was examined by Flückiger and Hanbury. Space cannot be here afforded to reproduce their report on the substance. The reader is referred to their *Pharmacographia*, p. 88, or to Dr. Dymock's *Materia Medica of Western India*, where, however, the account of the chemistry of this substance, as given by the authors of the *Pharmacographia*, is reproduced. By simple distillation with water they obtained 37 per cent. of an essential oil, leaving in

the still a dark viscid liquid resin. The sp. gr. of this essential oil was found by Flückiger and Hanbury to be 0.915, but by O'Shaughnessy it is given as 0.931, and by De Vry as 0.928. One of the most remarkable physical properties of this oil is the fact that at a temperature of 130°C. it becomes gelatinous, and on cooling does not recover its fluidity. The learned authors of the *Pharmacographia* found the resin to contain, like that of copaiba, a small proportion of a crystallisable acid, which may be removed by warming it with ammonia in weak alcohol. The portion of the resin which they found to be insoluble, even in absolute alcohol, was uncrystallisable. Werner, however, found a sample of garjan oil examined by him (as well as its resin) to be entirely soluble in boiling potash lye. The crystallisable acid extracted from the resin Werner called gurjanic acid ( $C_{44}H_{68}O_8$ ): it is soluble in alcohol 0.838, but not in weaker. It is dissolved also by ether, benzol, or sulphide of carbon. The amorphous resin, which forms the chief bulk of the substance obtained after the removal of the essential oil, has not as yet been definitely analysed. Flückiger and Hanbury found, however, that after complete desiccation it was not soluble in absolute alcohol. These authors add that a sample of garjan balsam of unknown origin yielded a crystallisable substance answering to  $C_{28}H_{46}O_2$ : and this was devoid of acid character. They would thus appear to have inferred that the garjan oil of commerce is not a substance of uniform chemical character; hence they conclude by recommending that "a comparative examination of the product of each of the above named species of *Dipterocarpus* would be highly desirable." Dr. Dymock, while not materially enriching the chemical knowledge of this substance, gives much interesting information as to the medical opinion held regarding the properties of the drug. The admission of different chemical and medicinal results confirms to a large extent the contention advanced in this work, *viz.*, that there are at least two widely different substances sold in the markets of India under the name of Garjan oil, the Kanyin, and In Oils of Burma.

TESTS FOR GARJAN, COPAIBA, AND HARDWICKIA BALSAMS.—Dr. Watson says: "Its entire solubility in coal naphtha proves the absence of any of the soft resin which exists in most of the copaiba of commerce." It may be distinguished from copaiba or the balsam of *Hardwickia* thus: shake up 1 drop of the balsam with 19 of carbon bisulphide, add one drop of nitro-sulphuric acid and agitate. Copaiba will show faint reddish-brown with a deposit of resin on the sides of the tube: garjan, intense purplish-red, soon becoming violet: while *Hardwickia* will not alter from its pale greenish yellow.

#### TRADE IN GARJAN OR WOOD-OIL.

The above special reports regarding the garjan oil of Burma and Chittagong make the usual admission that, owing to the cheap price of kerosine, the trade in wood-oil has very considerably declined. It is now mainly used for torches and in waterproofing, etc. The trade in the medicinal garjan oil must be very limited indeed. It appears to be mainly obtained from the Andaman Islands, and to be the produce of *D. alatus*, and possibly *D. turbinatus*.

Flückiger and Hanbury (*l. c.*) state that the world's supply is



obtained from "Singapore, Moulmein, Akyab, and the Malayan Peninsula, and that it is a common article of trade in Siam." (*Conf.* with Mr. Oliver's opinion above as to the plant which yields the Tenasserim oil.) "It is likewise produced in Canara in South India." "It is occasionally shipped to Europe." The Burma oil is most probably obtained from *D. turbinatus* and *D. alatus* (*Kanyin*) and from *D. tuberculatus* (*In*). Dr. Dymock remarks: "Garjan balsam is not an article of commerce in Bombay; small quantities may be sometimes obtained in the native drug-shops. The Government supplies have been obtained from the Andaman Islands." The late Dr. Moodeen Sheriff (in his work on the *Materia Medica of South India*) says that in Madras "wood-oil is pretty common in most large bazárs."

He describes several forms and gives their prices:—"Of the black or dark brown variety—wholesale, ₹12 per maund; retail or bazár, annas 10 per pound. Of the red or reddish-brown variety—wholesale, ₹24 per maund; retail or bazar, ₹1-4 per pound. Of the pale white or grey variety—wholesale, ₹18 per maund; retail or bazár, ₹1 per pound." He adds: "There are several varieties of garjan or wood-oil, but out of these, three are generally met with in the bazárs, which are known as *suféd garjan-ká-tél* or *suféd lakrí-ká-tél* (the pale white or grey variety), *lál garian-ká-tél* or *lál lakrí-ká-tél* (the red or reddish-brown variety) and *kálá garian-ká-tél* or *kálá lakrí-ká-tél* (the black or dark-brown variety)."

Fully fifty years ago hopes were entertained that garjan oil would become an article of European trade, meeting a demand in the arts. Dr. Royle wrote on this subject, and a member of the Agri-Horticultural Society of India consigned five hundred gallons to London. The effort proved futile, as Dr. Royle reports, because the Custom-house officers refused to pass it except at the highest rate of duty, namely, that for a manufactured article. It seems probable that this obstruction prevented the industrial enterprise of the British manufacturer from being able to discover a use for an article which has in consequence remained at a nominal value.

#### MEDICINAL USES OF GARJAN OIL.

Garjan balsam does not appear to have been used medicinally by the early Hindus. It does not bear any Sanskrit, Arabic, or Persian names. In Muhammadan works on *Materia Medica* it is first mentioned in the *Makhzan* under the name of *duhn-el-garjan*. Ainslie was the earliest European medical writer to mention it, and that in his *Materia Medica of Hindustan*—a work published in 1813. A prior notice occurs, however, in a work by Francklin (*Tracts on the Dominions of Ava*, p. 26) published in 1811. But Ainslie does not seem to have continued to value the drug, since in his larger and final work—the *Materia Indica*, published in 1836—he makes no mention of it. Sir William O'Shaughnessy in 1841 (*Bengal Dispensatory*, 222) recommended the balsam to the consideration of European physicians. He wrote: "The garjan balsam varies in consistence from that of a thick honey to a light oily liquid. The colour of a fine specimen of thick garjan obtained from Captain Jenkins of Assam was pale grey; specimens sent from Rangoon

by Mr. Speir were a light brown. As found in the bazar, this substance generally occurs as a brown oily-looking, semi-transparent liquid, in odour strongly resembling a mixture of balsam of copaiba with a small portion of naphtha." After giving the results of his chemical examination or division of the substance into its essential oil and resin, he continues:—"The close resemblance in the chemical properties of this garjan and copaiba balsam led to the institution of an extensive set of experiments on the medicinal effects of the former in the treatment of gonorrhœa. The results, which have been laid before the profession, and which have been confirmed by trials made by other practitioners, seem perfectly conclusive that in the treatment of gonorrhœa, gleet, and similar affections of the urinary organs, the essential oil of garjan is nearly equal in efficacy to the South American drug. The essential oil may be given in 10 to 30 drop doses in mucilage, milk, rice-water, or thin gruel, and repeated thrice or still more frequently daily. It generally causes a sensation of warmth at the epigastrium, eructations, and sometimes slight purging. It communicates a strong smell of turpentine to the urine, which it increases remarkably in quantity. Some obstinate cases of chronic gonorrhœa and gleet, which had long resisted copaiba and cubebs, have been cured by this remedy in the course of the experiments alluded to." "In the *Pharmacopœia* we have given a formula for a solution of the essential oils of garjan and cubebs in sulphuric ether, which affords a cheap but perfectly efficacious substitute for the celebrated 'Frank's Specific'."

Pursuing, in order of publication, the Indian works which treat of this substance, the *Pharmacopœia of India* in 1868 made it officinal. It is in that work described as a "stimulant of mucous surfaces, particularly that of the genito-urinary system, diuretic," and in a further page the results of various experiments with this substitute for copaiba are given. Dr. T. B. Henderson of Glasgow is said to have used it only when copaiba failed, and with remarkably good results. Dr. H. B. Montgomery found that it is apt to produce "an eruption of a character similar to that occasionally following the use of copaiba." Dr. Kanny Lall Dey, C.I.E. (*Indigenous Drugs of India*, p. 51), republishes the facts given above regarding the use of the drug in the treatment of gonorrhœa, but adds that "it is also used externally as a stimulating application to indolent ulcers." Waring (*Bazar Medicines*, p. 56) says it has the odour and taste of copaiba, but is less powerful. "It has been used as a substitute for this latter drug in the treatment of gonorrhœa, and trials with it in the hands of Europeans have shown that it is a remedy of no mean value in that affection. It is only advisable in the advanced stages, or when the disease has degenerated into gleet. In the latter affection it is stated to prove most useful. It is also well worthy of a trial in leucorrhœa and other vaginal discharges." Dr. Waring then proceeds to say that "great success has been found to attend its employment, both internally and externally, in the treatment of leprosy." He then quotes Dr. J. Dougall's proposed treatment for leprosy (*Indian Medical Gazette*, February 2nd and March 2nd, 1874) as follows: "Rise at day-light and wash the body thoroughly, using dry earth as a detergent, in which character it is more efficient than soap or bran. After this is completed, at 7 A.M. a dose of the emulsion is given, and for the next two hours the



patient himself should perseveringly rub in the ointment over his whole body. This is a point of importance, not merely smearing it in here and there, but using thorough and continuous friction over the whole surface for a couple of hours. This prolonged rubbing is not only insisted upon for the sake of the action of the ointment upon the skin, but because it is considered that any gentle employment, combined with exercise, proves beneficial both physically and mentally. After this inunction, breakfast may be taken, and some light employment followed during the day. At 3 P.M., a second dose of the emulsion is given, followed by another two hours' friction. Should the emulsion act too freely on the bowels, the dose should be diminished. In none of the cases treated by Dr. Dougall was there any change from the ordinary native diet, but we may reasonably expect even better results where a liberal supply of good and nourishing food is allowed. The success which has attended this treatment is very marked and encouraging and is fully confirmed by Dr. A. S. Lethbridge." (*Indian Medical Gazette*, 1st July, 1874.)

On the other hand, Dr. Dymock says of Dr. Dougall's reported success in the treatment of leprosy : "In order to test the correctness of this statement, large quantities of the balsam have been distributed by the Indian Government, but as far as I have heard the new treatment is not likely to prove successful. Dr. Dougall's directions for carrying out the treatment of leprosy by garjan balsam include frequent ablutions with dry earth and water, and strict attention to the hygienic condition of the patient ; it seems probable that he has attributed effects to the balsam which are in reality due to cleanliness and an improved hygienic condition. Within the last two years several tons of the drug have been distributed in the Bombay Presidency."

Dr. Moodeen Sheriff, the most recent writer on the subject of the properties of garjan balsam, says : "All the varieties of garjan oil are equally useful as a local stimulant, but the red or reddish-brown and the pale-white or grey varieties are the best for internal use. The best medical properties of this oil are its usefulness in gonorrhœa and gleet, and in all forms of psoriasis, including lepra vulgaris. In gonorrhœa and gleet it is at least equal to copaiba, and the only difference between these two drugs is that the former requires to be used in a much larger dose (2 drachms to 3 drachms) to produce the same effect as the latter. As garjan balsam is always used in the shape of emulsion with mucilage, the largeness of its dose is no disadvantage. With regard to its usefulness in psoriasis and lepra vulgaris, I am not aware of any other local stimulant which is more efficacious in those diseases than this drug. I have either cured or relieved many cases of the above affections by the use of this drug with little or no assistance of internal remedies. The internal use of wood-oil is also attended with benefit in some cases of true leprosy in its early stage ; but its efficacy in this respect is greatly enhanced with the addition of from five to ten drops of chaulmugra-oil to each drachm of it. If well mixed in the above proportions, the combination of chaulmugra-oil cannot be detected. Some years ago I received a bottle of gurjan-oil of this kind from a medical friend, which proved itself more useful in a case of true leprosy than all its varieties in the bazaar, but I did not know the existence of chaulmugra-oil in it until I was informed of it." Martindale and Westcott say : "It is



very florescent, has an opaque, dingy, greenish grey colour seen by reflected light, yet is transparent and reddish-brown in strong day-light; it has the weak aromatic odour and bitterish aromatic taste of copaiba without the acridity—has been used as an adulterant of copaiba. It is not completely soluble in either ether or alcohol; emulsified with mucilage of *Acacia*, it is used with success like alcohol; for gonorrhœa and, in the East, as a remedy for leprosy, an emulsion is made of equal parts of the balsam and lime water, which is used freely as a liniment and given to the extent of 4 drachms three times daily."

SPECIAL OPINIONS.—"Very effectual in relieving true leprosy. Dose internally as in the *Pharm. Ind.*; for an ointment take of the oil 1 part, lime water 3 parts; useful for chronic skin diseases and true leprosy." (*Apothecary, Madnapalle, Cuddapah.*) "Garjan oil is of undoubted efficacy in tuberculous leprosy." (*Civil Surgeon R. D. Murray, Burdwan.*) "Very useful in cases of leprosy. Externally the oil should be well rubbed into the affected parts. Internally it is taken in doses of 3 drachms or 1 drachm mixed with lime water or *Liq. Potassæ*." (*Civil Surgeon J. Anderson, Biinor.*) "I have tried it frequently in cases of leprosy; it is a good dressing, and heals the ulcers as well as if not better than any other application, and the inunction of the oil does the sufferer good constitutionally, but it is certainly not a specific for leprosy, nor does it stop the nerve disease." (*Surgeon-Major C. W. Calthrop, 4th Bengal Cavalry, Morar.*) "The oil with a little corrosive sublimate and sulphur is a capital remedy for ringworm." (*Surgeon-Major P. N. Mookerji, Cuttack, Orissa.*) "I used this oil for two years in the treatment of leprosy, but found it perfectly useless." (*Brigade Surgeon C. Joyut, Poona.*) "*Gurjun tél*,—The Andaman oil is the best, and useful in leprosy. Taken internally and applied externally too." (*Civil Surgeon C. M. Russel, Sarun.*) "Is a good dispensary substitute for copaiba in gonorrhœa and mucous discharges. Its internal and outward use in leprosy is highly recommended". (*Dr. Picachy, Civil Medical Officer, Purneah.*) "I experimented for two years with garjan oil as a cure for leprosy in the lepra ward at Burdwan in 1875-76-77. It is useless as a specific, which it was claimed to be, but the ointment is a fairly good application for leprous and other ulcers." (*Civil Surgeon C. H. Joubert, Darjeeling, Bengal*) "The balsamic exudation of *D. turbinatus* or garjan balsam is a very valuable external and internal stimulant. It exercises more or less beneficial influence over all skin diseases, but its curative effect in those of a scaly nature as lepra vulgaris and psoriasis is highly satisfactory. Many a case of the last-named disease has been relieved by its external use with little or no assistance of internal remedies. I have also employed it pretty extensively in the cure of gonorrhœa, and quite agree with what is already mentioned on this point. There are several varieties of garjan balsam, but the thin and reddish brown variety is about the best." (*Honorary Surgeon Moodeen Sheriff, Khan Bahadur, Triplicane, Madras.*) "Useful application in scabies. It did not prove so useful in my hands in gonorrhœa when administered alone." (*Assistant Surgeon Shib Chundra Bhattacharji, Chanda, Central Provinces.*) "Recently much praised as a cure for leprosy. I have not been able to obtain any remarkable effects from its use." (*Civil Surgeon G. Price, Shâhabad.*) "The oil prepared



into an ointment for external application, and given internally in leprosy in early stage of the disease, undoubtedly arrests further progress, and affords great relief in advanced cases. The ointment is prepared by mixing the oil with lime water in equal parts, and churning it into a creamy substance. It should be well rubbed into the affected parts, for at least 15 minutes, every morning and evening.

The oil given internally from one to ten drops, morning and night, in cold water." (*Civil Surgeon S. M. Shircore, Moorshedabad.*)

"Garjan oil was used extensively at the penal settlement of the Andamans in the treatment of leprosy. After long trial it was found to act beneficially in many cases as a palliative remedy, but as a specific for the cure of leprosy it completely failed." (*J. Reid, Principal Medical Store-keeper to Government, Fort William.*)

After reviewing the various trials which have been made with garjan oil, the Leprosy Commission, 1890-91, in their recently issued Report, state that "it appears that, though a certain amount of temporary relief may follow its use, it is very doubtful whether this is more than can be obtained with any common oil. Dr. Dougall's success at Port Blair was probably due to the fact that he was dealing with a colony of convict lepers under prison treatment, and was therefore able to carry out his plan of treatment for more rigorously than in an asylum where, as a rule, patients are averse to any therapeutic measures which involve the least exertion. It is quite possible that the prolonged frictions with dry earth, and the regular sea bathing, were quite as potent in affording relief as the use of the garjan oil."

#### DOMESTIC AND INDUSTRIAL USES OF GARJAN OIL.

It is extensively employed by the Burmans as torches, but now-a-days it is only used to a limited extent as a lamp oil. It is largely employed in preserving bamboo wicker-work from the attacks of insects and in paving the bottoms of boats. It is also used as a varnish. It is reported to be useful as an ingredient in lithographic ink. In European medicine it is mainly utilised as an adulterant for copaiba. But it is commonly held that, if a process could be discovered of causing it to dry more rapidly, it would come largely into European use as a varnish. It has been suggested that this might be effected by mixing it with some good drying oil, or by evaporating away the essential oil. It seems to the writer, however, that a far more important way of utilising the article might be found in taking advantage of Mr. Laidlay's discovery that it acts as a solvent of caoutchouc. A thick coating of India-rubber is of course perfectly water-proof, but the way in which India-rubber sheetings, overcoats, etc., harden, dry, and crack at one season of the year or stick together at another under the tropical climate of India, would recommend the experiment being made to ascertain if this would be also the case with a water-proofing material made of a solution of India-rubber in garjan oil. The merits of garjan oil have at all events not received sufficient attention by the manufacturer, and Sir William O'Shaughnessy's opinion may be here quoted in favour of the desirability of the matter being looked into in the future. Sir William wrote fifty years ago that garjan was "likely to be found a perfect substitute in the arts

for the expensive balsam of copaiba, now much used in the preparation of colourless varnishes and drying paints. In the coarser kinds of house and ship painting, garjan balsam is used as an excellent substitute for linseed oil." Dr. Wight also speaks highly of the property of garjan in preserving wood, etc., from the attacks of insects; its defects are slowness of drying, thin body when dry, and liability to being brittle.



## IN OR ENG OIL.

*Dipterocarpus tuberculatus*, Roxb.

ENG OR IN TREE.

**Syn.**—*D. GRANDIFLORUS*, Wall.**Vern.**—*Eng* or *In*, BURM.; *Soahn*, TALEING.**Habitat.**—A large, deciduous, gregarious tree, forming the In Forests of Burma and Chittagong. Distributed to Siam.

## OLEO-RESIN.

According to Roxburgh, Gamble, Kurz and other authors, this tree does not yield a wood-oil, but exudes a clear yellow resin. Mr. J. W. Oliver, Deputy Conservator of Forests, informed Dr. Watt, however, that it does yield an oil, but of considerably thicker subsistence (an oleo-resin) than the kanyin oils described under *D. turbinatus*. "In oil," Mr. Oliver says, "is the product of *D. tuberculatus* (Burmese *In* or *Inma*—female *In*), and is always found on laterite, gravel or clay, very often forming pure forests. The process of extraction practised in the Prome and Tharawaddy districts is as follows: A deep semicircular niche, with a convex roof, is made through the sap-wood near the foot of the tree, extending round one-third of its circumference, with a hollow in the lower portion of the cut to receive the oil. After a few days the oil is collected, and the wood on the upper surface of the incision chipped away so as to expose a fresh surface of sap-wood. This chipping has to be frequently repeated, as the pores of the wood become clogged with congealed oil. In many cases fire is also applied to the cut, but this appears to be not absolutely necessary. The object of firing is probably the same as that of chipping, *viz.*, to remove the congealed oil. The latter is very inflammable, and the cut surface invariably gets burned during the jungle fires, whether fire is used in collection or not, so that between chipping and burning a wound, some 6 feet long by 2 feet wide, is formed in the side of the tree. The tree thus gets gradually cut or burned through, and falls over by its own weight. The oil is collected from four to ten times a month. A man and boy can look after about 300 trees, which yield about 20 viss a month. The time of collecting lasts from August to February. At the end of the season the congealed oil or resin which remains in the hollow is scraped off, and used for torches which are made of rotten wood mixed with oil and resin, and rolled up in the leaves of the *satthwa*—a species of screw-pine common along the banks of streams in *In* forests. The oil is also largely used for water-proofing bamboo-baskets, for well-buckets, etc. The selling price of oil in the Prome and Tharawaddy districts in 1882 was 5 to 7 viss for the rupee."

The following notes on the Burmese In oil were recently prepared by the Deputy Conservators of Forests, Pegu Circle and Prome Division.

respectively, in connection with the collections which were made for the Imperial Institute :—

(a) *Pegu Circle.*

In the Zamayi range Eng oil is extracted in small quantities for making torches, which, when manufactured, sell at the rate of Rs 4 per 100. The method followed in obtaining the oil is as follows :—

From January to April trees of 6 feet girth and upwards are selected. In these trees, at a height of about 3 feet from the ground, incisions 9 inches to 10 inches deep and about 1 foot wide are made into the heart-wood of the Eng tree. This incision is concave at the bottom, the concavity being large enough to hold from 20 to 50 ticals weight of the oil. The number of incisions varies from one to two in trees of 6 feet girth to 5 in trees of 15 feet girth. The oil is taken out three days after making the incision, and the hole is slightly fired.

After two years, if the upper surface of the incisions is pared, the oil again flows, but, after this has been done once or twice, it would appear that the oil does not exude, or, at least, not in sufficient quantity to make it pay, as fresh incisions are made some feet above the old decayed ones.

From the oil with *Salu* leaves and chopped wood (?) torches are made about 18 inches long and 6 inches in diameter.

(b) *Prome Division.*

The In tree forms pure forests by itself, but other trees, such as Thitya and Thitsi, are often found growing in conjunction with it. The extent of almost pure In forests in the Prome District is nearly 100 square miles.

The age of tapping the tree is uncertain, but no trees are tapped before attaining a girth of about 4 feet.

The means employed to get the oil is to make a triangular cut in the tree to a depth of about 6 inches into the heart-wood, forming a kind of well. It is the usual thing for a tapper to make three of such wells in one tree at the same time. Every seven days for about two months he comes and takes away the oil in pots.

At the end of two months he removes to another tree. The only instrument used is a Burmese axe.

The oil, on being taken from the tree, is put in a pot, and about 15 per cent. of earth oil is added. It is then boiled for about an hour, and afterwards allowed to cool : as it cools it hardens and becomes resin.

The resin is used chiefly for caulking boats ; otherwise there is not much demand for it. If mixed in the proportion of  $\frac{2}{3}$  earth oil and  $\frac{1}{3}$  In oil, the compound is used to spread on Burmese umbrellas to render them water-tight.

A man working for a year (and resin can be obtained all the year round) gets about 200 viss of resin ; which is sold at Prome at about 6 annas a viss. About 1,500 viss of resin are sold in Prome in a year.

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